REMARKS/ARGUMENTS

Claims 1-25 and 29-40 remain in this application. Claims 26-28 have been withdrawn.

The Examiner rejected claims 1-9, 11-14, 17, 19, 21, 23-40 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,452,177 (Frutiger) and claims 10, 15, 16, 18, 20 and 22 under 35 U.S.C. 103(a) as obvious over Frutiger in view of U.S. Patent No. 5,581,324 (Miyai). In order to overcome these rejections, all of the independent claims, claims 1, 8, 19, 29 and 36, have been amended to include the limitations that the apparatus includes: 1) a temperature sensor for determining the temperature of the wafer and 2) a computer which receives wafer temperature information and determines the position of the wafer as it deforms due to thermal expansion. The temperature sensor and computer limitations are supported by the specification at page 18 lines 1-6. The claims have also been amended to change the term "substrate" to "wafer" to avoid confusion between the mask which blocks some of the light and the wafer upon which electronic devices are fabricated.

The Examiner rejected claims 1-9, 11-14, 17, 19, 21 and 23-40 by arguing that Frutiger teaches a wafer holder for retaining a substrate within a processing chamber comprising: an electrode; and one or more layers covering a portion of the wafer holder in contact with the wafer where at least one of the layers is compliant. (Office Action page 2.) The Examiner admits that Frutiger does not disclose a system which detects the temperature of the substrate, but stated that U.S. Patent No. 5,581,324 (Miyai) discloses a computer for calculating an estimated charged particle beam deflection to compensate for the actual deformation of the substrate caused by the exposure of the substrate to the charged particle beam, a substrate temperature sensor for measuring the temperature of the substrate during processing and for sending a signal corresponding to the measured substrate temperature to the computer. (Office Action pages 6-7.)

The applicant respectfully submits that neither Frutiger nor Miyai discloses temperature sensors for determining the position of the wafer as it deforms due to thermal expansion. Miyai discloses an optical lithography system which includes a mask temperature detector and a mask deformation measurement system. In the Miyai lithography system a light rays are transmitted

through a patterned reticle so that a specific pattern of light is directed to a wafer. Because much of the projected light is blocked by the reticle, a substantial amount of heat is absorbed by this structure. Temperature sensors only detect the reticle temperature and only the reticle temperature information is forwarded to a temperature data processing unit. (Miyai, Col. 7, line 30 - Col. 9, line 16.)

The applicant respectfully submits that Miyai does not suggest determining the position of the wafer as the physical dimensions of the wafer change due to thermal expansion because it teaches a method for maintaining the wafer at a constant temperature. Miyai discloses controlling the temperature of the apparatus by blowing clean air in a lateral direction over the planar surface of the wafer. (Miyai, Col. 34, lines 61-66.) Thermal expansion of the wafer is prevented because the wafer maintained at a constant temperature, thus there is no suggestion of determining the change in position of the wafer due to thermal expansion.

The applicant also respectfully submits that neither Frutiger nor Miyai disclose or suggest a charged particle beam lithography system. Frutiger discloses an electrostatic wafer clamping system used in an ion implantation system. Ion implantation is a technique used in the manufacture of semiconductor devices in which impurities are implanted below the surface of the wafer by means of electrically accelerated ions. This ion implantation process does not require directing the ions at the substrate in a precise pattern. In contrast, charged particle beam lithography is a process in which electrically charged particles are directed in a precise pattern onto the surface of a substrate. These projected patterns are required to form the circuitry of the electronic devices being fabricated.

Although Miyai discloses a lithography system, it only discloses an optical system. There are substantial differences between optical lithography and charged particle lithography systems and most of the required components are not interchangable. Optical lithography uses a light source, an optical mask and optical lenses in a pressurized chamber to project a pattern onto a wafer. In contrast, charged particle beam lithography requires: a charged particle source, magnetic field lenses, and a particle mask. The charged particle beams are focused by magnetic fields which are also known as magnetic lenses. There is also a substantial difference between

optical and charged particle masks. Optical masks simply block light rays, in contrast masks for charged particles such as electrons require special materials which may only be able to divert the particle path rather than completely block the charged particles. The processing chambers are substantially different as well. As discussed, optical lithography can take place in a pressurized chamber and charged particle beam processing must be performed in a vacuumed processing chamber. Because optical and charged particle lithography are such different technologies, Miyai does not disclose or suggest charged particle beam lithography.

The applicant respectfully submits that it is improper to combine the Frutiger and Miyai references. As discussed, Frutiger discloses an electrostatic clamping apparatus which is used with an ion implantation system that requires processing in a vacuum environment. (Frutiger, Col. 4, lines 42-46.) In contrast, the optical lithography system disclosed in Miyai includes a temperature control system having a clean air circulation system which requires the presence of gas and some pressurization. (Miyai, Col. 34, lines 61-64.) Because Frutiger requires a vacuum chamber and Miyai requires a pressurized processing chamber, the two systems are inherently incompatible and it is therefore improper to combine these references.

With regards to claims 7 and 17, the Examiner states that Frutiger teaches a chuck wherein the compliant layer is between 1 and 3 μm thick. Frutiger discloses a "silicone rubber having a thickness of 0.006 inch." (Frutiger Col. 9, lines 37-38.) This thickness is equivalent to 0.01524 centimeters which is 152.4 μm. The applicant submits that Frutiger does not disclose a compliant layer is between 1 and 3 μm thick.

With regards to claim 8, the Examiner states that Frutiger teaches an apparatus for projecting patterned charged particles onto a substrate. The applicant respectfully submits that the Frutiger does not disclose or suggest projecting patterned charged particles onto a wafer. Frutiger discloses that the disclosed pedestal is suitable for use with ion systems including: ion implantation, ion milling and ion etching. (Frutiger Col. 1, lines 20-36.) Frutiger does not disclose any specific information about how the charged particles are used. Ion implantation is a well known semiconductor process in which ions are uniformly implanted into the surface of a wafer. There is no pattern of charged particles associated with this process. Similarly, ion

milling and ion etching are well known processes in which accelerated ions are used to remove material from the surface of wafer without a pattern of charged particles. Thus, neither Frutiger nor the specified processes disclose or suggest projecting a pattern of charged particles.

Similarly, with reference to claim 19 the Examiner states that Frutiger teaches a method for patterning a photoresist layer on a substrate, comprising the step of forming a photoresist layer on the substrate. The applicant again respectfully submits that Frutiger does not disclose or suggest any sort of patterning for the same reasons discussed in reference to claim 8 above.

Claims 10, 15, 16, 18, 20 and 22 were rejected by the Examiner over Frutiger in view of Miyai. The Examiner stated that Miyai discloses a computer for calculating an estimated charged particle beam deflection to compensate for the actual deformation of the substrate caused by the exposure of the substrate to the charged particle beam; a substrate temperature sensor for measuring the temperature of the substrate during processing and for sending a signal corresponding to the measured substrate temperature to the computer; and wherein the localized heating of the substrate due to exposure to the charged beam is between 1° C and 50° C. (Office Action pages 6-7.) The applicant respectfully submits that Miyai does not disclose or suggest a computer for calculating the charged particle beam deflection to compensate for the actual deformation of the wafer. As discussed above with regards to claim 1, the Miyai patent discloses an optical lithography system that only makes adjustments to the optical lenses to compensate for the thermal expansion of the mask. The Miyai system maintains the wafer at a constant temperature so there is no thermal expansion or any need to compensate for wafer movement.

With regards to claims 15 and 22 the Examiner stated that Miyai discloses a lithography mask positioned between the charged particle source and the substrate and an electron sensor disposed within the processing chamber for detecting backscattered electrons emanating from the substrate and using a charged particle beam to scan a first mark on a photo lithography mask on a second mark said substrate; detecting backscattered electrons, determining the position of the substrate using the detected backscattered electrons and deflecting the charged particle beam in response to the measured position of the substrate. The applicant respectfully disagrees with this analysis. Miyai discloses an optical alignment system in which an alignment marks on the mask

are detected and the mask is aligned based upon the detected position of the mask marks. (Miyai Col. 23, lines 51-55.) The alignment system disclosed in Miyai does not disclose or suggest projecting an alignment mark onto the substrate.

In contrast to the alignment system disclosed in Miyai, the claimed limitations are directed towards an electron beam that projects a mark on a mask onto the wafer being processed. The claimed alignment system determines the position of the alignment mark by detecting the backscattered electrons emanating from the wafer. Neither Miyai nor Frutiger disclose or suggest scanning a mark on a mask onto a wafer and detecting the backscattered electrons.

Applicant respectfully requests that a timely Notice of Allowance be issued in the case.

Respectfully submitted,

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